Roller Mill Dam Removal Effects on Chiques Creek

Interim Technical Summary: Additional Pre-Dam Removal Sampling in 2025

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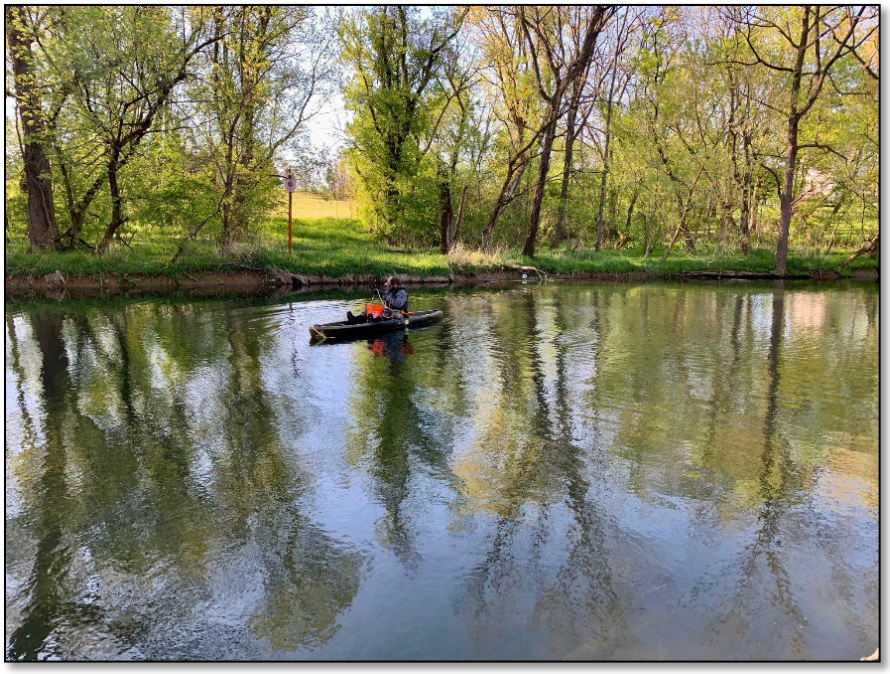

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INTRODUCTION

In 2020, the Susquehanna River Basin Commission (Commission) established a study area on Chiques Creek above and below Roller Mill Dam to study the effects of a proposed dam removal on stream channel dynamics, water quality, and aquatic communities (Figure 1). The Roller Mill Dam (RMD) was originally slated to be removed in Spring 2021 but has been pushed back annually. The delays were caused by regulatory hold ups as well as continued funding issues. However, permitting is currently underway and work is progressing towards dam removal within calendar year 2027.

In early 2022, consultants estimated the dam was holding back three times the entire sediment allotment given to the entire Chiques Creek Watershed in draft Total Maximum Daily Load (TMDL) calculations. The potential release of this sediment raised concerns by other watershed stakeholders who need to comply with sediment load allocations. These consultants also estimated partial removal of that sediment prior to dam removal to cost around 3 million dollars, with estimates for total removal topping 8 million dollars. The decision to spend this amount of money to remove a dam in a heavily impacted watershed with multiple other intact dams is facing numerous challenges and roadblocks. In spring 2023, the Commission awarded American Rivers a Consumptive Use Mitigation Grant for approximately $500,000 towards the removal of Roller Mill Dam to support the ways in which it will have long-term benefits for the watershed.

Over the past few years, the Commission has continued to attend periodic stakeholder meetings regarding the dam removal with American Rivers, National Resources Conservation Service (NRCS), PA Department of Environmental Protection (PADEP), PA Fish and Boat Commission (PFBC), consultants, academia, and local municipalities. While the project feasibility aspects are under investigation, the Commission continues in its role in collecting baseline data in the study area at a series of monitoring sites. The Quality Assurance Project Plan (QAPP) for the study on the effects of the dam removal as well as updates on data collection to date have been shared with American Rivers and their consultants to avoid duplication of monitoring efforts.

This project has two objectives:

1. To document a case study showing changes in physical, chemical, and biological characteristics of Chiques Creek after the removal of the RMD.
2. To quantify the elapsed time to achieve stability in physical and biological conditions following dam removal.

The Commission conducted additional pre-dam removal sampling in the study area in 2025. Like the sampling from 2020-2024, this additional sampling was funded in part by the U.S. Environmental Protection Agency (USEPA) through a Water Pollution Control (Section 106) grant.

This short technical memo will serve two purposes:

1. To summarize the sampling efforts conducted from October 2020 through June 2025 (Table 1).
2. To present the baseline data collected through June 2025.

Figure 1. Map of All Monitoring Locations Associated with the Pre-Dam Removal Monitoring on Chiques Creek

METHODS

The Commission collected extensive pre-dam removal data in 2020 and 2021, and reports detailing those results are available (Steffy, 2021; Steffy, 2022; Steffy, 2023; Steffy, 2024). Since the dam has not yet been removed, the Commission targeted only a few parameters for additional sampling in 2025. Commission scientists followed the field methods outlined in the USEPA-approved QAPP (SRBC, 2020) to collect water quality and macroinvertebrate samples and physical habitat data and conduct data analysis (Table 1).

Table 1. Summary of Pre-Dam Removal Monitoring Activities (2023 activities in red)

Category	Activity	Date Completed
Physical Habitat	Cross-sectional and bathymetric analysis of the 200 m downstream of RMD	November 2020, November 2021
Physical Habitat	Pebble counts	October 2020 and May 2021, November 2021, April 2022, June 2023, June 2024, June 2025
Physical Habitat	Bank pin deployment	November 2020, April 2022, June 2023
Water Quality	Water sampling for WQI parameters above and below RMD	November 2020 and April 2021, March 2022, April 2023, April 2024, July 2024, March 2025
Biological	Macroinvertebrate sampling above and below RMD	November 2020 and April 2021, March 2022, April 2023, April 2024, March 2025
Biological	Fish assemblage surveys above and below RMD	June – August 2021

Water Quality

Six additional water samples for laboratory analysis were collected in March 2025 to supplement the pre-dam removal dataset and answer some outstanding questions important to dam removal planning efforts. Susquehanna Water Quality Index (WQI) scores (Berry et al., 2020) were calculated for each of these samples to compare among sites and across time. WQI scores range between 0 and 100 (the greater the number, the better the water quality). Each of three categories (metals, nutrients, development) that make up the WQI are scaled similarly and have equal weight in the overall WQI score.

In March 2025, samples taken above the dam and below the dam were very similar: a majority were considered “Poor” water quality with WQI scores between 32-45, regardless of upstream location in relationship to RMD (Table 2).

Table 2. WQI Results from March - April 2025 Sampling in Chiques Creek

Site #	**7**	**B**	**RMD**	**2**	**2**	**4**	**A**
Distance (m) above/below RMD	100 m below dam	10 miles below dam		100 m above	300 m above	3,500 m above	6 miles above
Date	4/29/25	3/31/25		3/31/25	3/31/25	3/31/25	3/31/25
Metals	53.1	85.17		66.57	67.8	79.53	63.83
Nutrients	18.8	43.25		33.85	29.45	25.3	21.1
Development	9.8	7.13		8.1	8.33	8.07	11.1
WQI SCORE	**27.2**	**45.18**		**36.17**	**35.19**	**37.63**	**32.01**
WQI Rating	**Very Poor**	**Fair**		**Poor**	**Poor**	**Poor**	**Poor**

Macroinvertebrates

Macroinvertebrates were collected at multiple locations along the pool length above RMD using an Eckman dredge and at two sites above the influence of the RMD and two sites below RMD using a standard D-frame net. PADEP IBI scores (PADEP, 2013) were calculated for all samples (Table 3). Not surprisingly, taxa richness, diversity, EPT taxa with low tolerance to pollution, relative abundance of sensitive taxa, and overall IBI scores were lowest in the pool above the dam.

The IBI scores seen in 2025 are consistent with results from macroinvertebrate samples collected across multiple years in free-flowing sections throughout the Chiques Creek Watershed and have always shown the presence of impaired macroinvertebrate communities. One of the expected benefits of dam removal is the improvement of macroinvertebrate habitat in the nearly 2 kilometers of upstream channel currently impounded by the dam where the substrate is dominated by fine sediment, clay, and muck in depths of up to 8 feet. The macroinvertebrate communities in the pool above the dam were dominated by Chironomids. While Chironomids dominated the macroinvertebrate community below the dam, the slightly more complex substrate and free-flowing hydrology supports a more diverse, but still impaired, community downstream of the RMD. Interestingly, while sampling using the Eckman dredge in spring 2025, staff noted less muck and more coarse gravel substrate in the pool above the dam. Reasons for this are unknown and will be evaluated again in 2026. It is possible that some of the fine sediment was scoured out during a high flow event due to the limited storage behind the dam from years of filling in.

Table 3. Summary of Mean IBI Score and Select Metrics Above and Below RMD

Metric	Upstream in Pool 2025	Upstream out of Pool influence 2025	Downstream 2025
Taxa Richness	7	17	16
Hilsenhoff	6.31	4.84	4.54
EPT PTV 0-4	0	2	4
IBI Score	**15.3**	**36.0**	**40.5**

Pebble Counts

Pebble counts have been completed routinely in the 450 meters below the RMD with the goal of documenting the relative stability of the substrate type and median particle size (Figure 2). Zig zag 100 pebble counts were done using a standard gravelometer. Having a documented pre-dam removal substrate characterization will be valuable for determining how long it takes after dam removal for the stream to return to its pre-removal stable state.

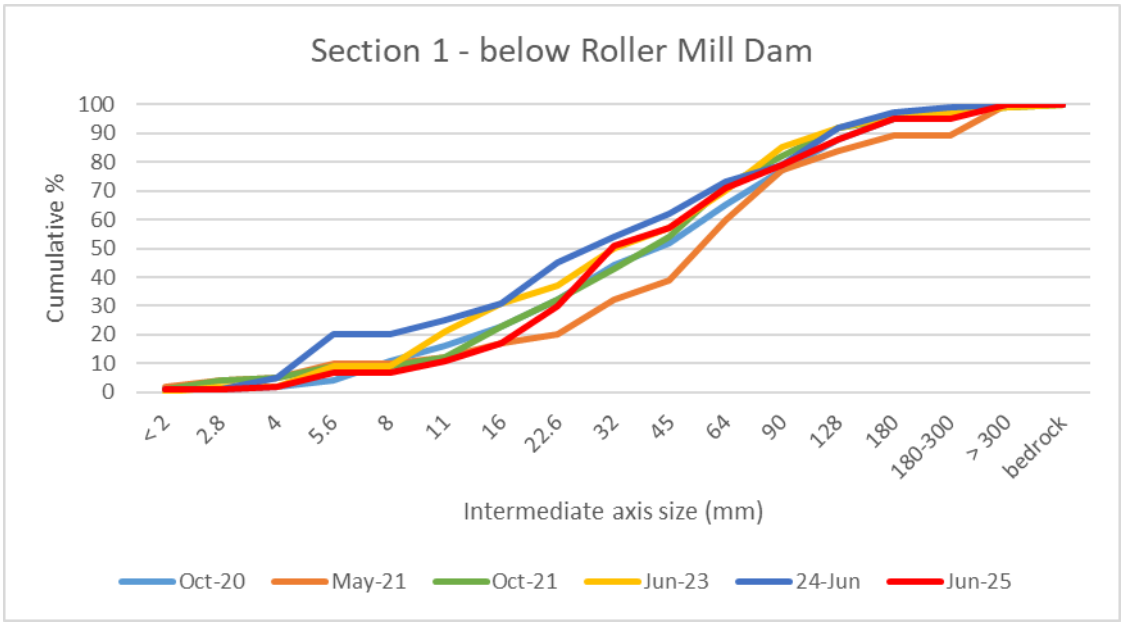

Figure 2. Pebble Count Cumulative Frequency Plot for Section 1, Below Roller Mill Dam, 2020-2025

Little Chiques Creek

Commission staff is also using some of these funds to continue to monitor the long-term shifts in sediment composition in Little Chiques Creek after the removal of the Cove Overlook Park dam in 2019. The dam was removed without any warning so no pre-removal data were collected, but staff has been conducting water quality sampling and pebble counts annually throughout the reach over the last five years. Water quality is poor and largely unchanged and consistent through the study reach, but fine sediments are slowly being flushed through the system and median substrate size is increasing (Figure 3). After RMD is removed, a comparison will be done on sediment shifts, and time frames for recovery post dam removal will be evaluated.

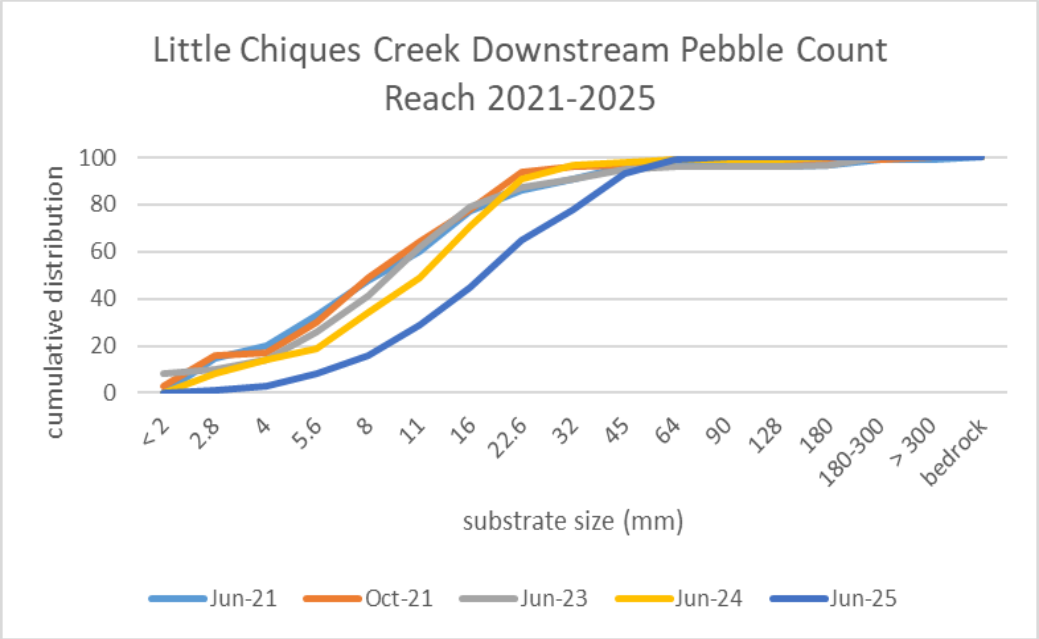

Figure 3. Shift in Median Substrate Particle size in Little Chiques Creek after a dam removal

Next Steps

The Commission will continue to track the progress of the proposed removal of Roller Mill Dam and participate in stakeholder meetings over the next few years. Additional pre-removal monitoring will occur as needed until the dam is removed. The Commission operates and maintains a continuous instream monitoring station downstream of the dam, which will be a key component for collecting instream data, particularly turbidity, during the removal process. Commission staff will be acutely aware and involved in the progress and status of this dam removal when it eventually begins and will be able to employ adaptive monitoring as appropriate.

In the weeks and months after the dam is removed, the Commission will sample for the same parameters to assess change. Additionally, the Commission plans to sample biological communities at longer intervals post-dam removal (i.e., every 1-3 years).

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